DOCUMENT RESUME

ED 403 318 TM 026 055

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TITLE QED: Final Report on the NSF Grant to the Science Academy of Austin, 1994. Publication Number 94.04.
INSTITUTION Austin Independent School District, TX. Dept. of Performance Audit and Evaluation.
SPONS AGENCY National Science Foundation, Arlington, VA.
PUB DATE Mar 96
CONTRACT TPE-9053838
NOTE 20p.
PUB TYPE Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Curriculum Development; *Educational Technology; Elementary Secondary Education; Financial Support; Grants; High School Students; Holistic Approach; Interdisciplinary Approach; Outreach Programs; *Partnerships in Education; Pilot Projects; Program Evaluation; *Science Education; Staff Development; *Thinking Skills; Tutorial Programs; Water Quality
IDENTIFIERS *Austin Independent School District TX; *Science Academy of Austin TX

ABSTRACT

The Science Academy of Austin, part of the Austin Independent School District (Texas), was given a 4-year National Science Foundation (NSF) grant beginning in 1990-91 to link public and private sectors to create a "thinking curriculum." This evaluation report covers the fourth, and last, year of the grant's implementation. The new curriculum aimed to improve teaching skills in kindergarten through grade 12 with technology tools that are available but underutilized and to increase student performance in science using holistic interdisciplinary approaches with opportunities to apply concepts in real-world settings. Funds were used for curriculum development, staff development, student participation, and private sector involvement. In 1994 a new curriculum focusing on water quality was completed and readied for pilot testing. Staff development concentrated on technology, and high school students participated in elementary school outreach activities. Forming partnerships with local corporations, government, and institutions of higher education produced resources and quality assurance. Although the NSF grant period has ended, the programs introduced through the grant are of sufficient value that it is recommended that the Science Academy of Austin continue to seek grant funding for teacher training, student outreach, curriculum development, and partnership promotion. (SLD)

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ED 403 318

QED: 1994-95 Final Report

On the National Science Foundation Grant

To the Science Academy of Austin

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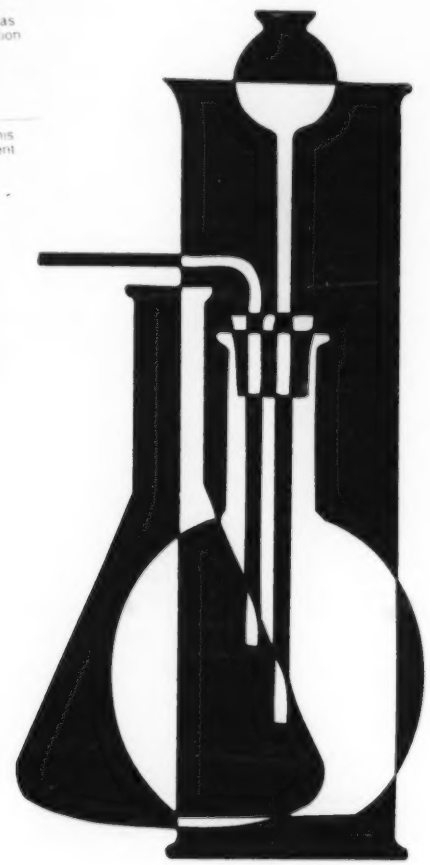

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Austin Independent School District

Department of Performance Audit and Evaluation

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ACKNOWLEDGEMENTS

The author would like to acknowledge the contributions of the following Science Academy staff for their time and assistance in providing data for this report:

Mary Long, Director

Wes Halverson, Ph.D., Teacher

Barbara Harris, Secretary

Annette Ruback, Secretary

ACKNOWLEDGEMENT OF SUPPORT

This material is based upon work supported by the National Science Foundation under Grant No. TPE-9053838. The Government has certain rights in this material.

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QED: Final Report on the NSF Grant to the Science Academy of Austin, 1994

Executive Summary

Austin Independent School District
Department of Performance Audit and Evaluation

Author: Jeannine Turner

Program Description

The Science Academy of Austin was given a four-year National Science Foundation (NSF) grant beginning in 1990-91. This evaluation report covers the fourth, and last, year of the grant's implementation.

The NSF grant provided a vehicle for linking the public and private sectors in Austin with the school system, providing in-depth partnerships for creating a "thinking curriculum." This new curriculum had two major goals:

1. To improve teaching skills (grades K-12) with technology tools that are available but underutilized, and

2. To increase student learning and performance in science using holistic, interdisciplinary approaches with opportunities to apply concepts in real-world settings.

To address these goals, the NSF grant activities were divided into four components: *curriculum development, staff development, student participation, and private sector involvement.*

From the beginning of the spring 1991 semester through the fall 1994 semester, NSF funds provided:

- Staff development in technology and environmental issues;
- Student involvement in outreach activities to elementary schools;
- Development of *Watershed Studies*, a groundwater curriculum for high school students;
- Development of new private and public sector partnerships, as well as the expansion and/or maintenance of existing private and public sector linkages;
- Follow-up on previously funded curricula development and implementation;
- One half-time secretary;
- One half-time project facilitator; and
- Program evaluation.

Major Findings

1994 Activities:

1. During 1994, a new curriculum that focuses on how humans impact water quality was completed, and is currently ready for pilot testing (pp. 4, 11).

2. In accordance with grant specifications, staff development focused on available but underutilized technology, and on innovative technology and programs. Participants in technology training indicated that their training was relevant to their teaching and would be helpful and beneficial in organizing and running their classrooms (p. 4).

3. Nearly all high school students who participated in elementary outreach activities believed that their participation was important to the elementary students by making learning science fun and by providing them with role models for future academic success in science (p. 5).

4. Forming partnerships with local corporations, government, and institutes of higher education produced resources and quality assurance. Participants from public organizations and private companies were involved in all aspects of grant implementation (p. 6).

Four-Year Grant Activities:

1. Throughout the four-year grant, NSF funds provided student outreach activities, curriculum development, and technology training for teachers.

2. The development of new private and public sector partnerships, as well as the expansion and/or maintenance of existing private and public sector linkages.

3. Four curricula were developed through collaborative efforts of teachers, technology practitioners, and environmental science practitioners. All curriculum development projects incorporated reform recommendations from the Studies of Education Reform and the American Association for the Advancement of Science (AAAS) and were in line with the grant's goal of developinng integrative science courses that use holistic, interdisciplinary approaches.

Budget Implications

Mandate: External funding agency
Funding Amount: $349,250 (total for four years); $77,994 (for fourth year)
Funding Source: National Science Foundation (NSF)

Implications: The grant provides funding to enhance student learning/involvement and addresses the District's first, second, and fifth strategic objectives of:

- Having every student function at his/her optimal level of achievement and of having every student progress successfully through the system,
- Having all students function successfully at or above international standards, and
- Upgrading the quality of course content and the effectiveness of instruction.

Funded activities also meet the District's valuing and appreciation of:

- Motivating learning and defining student achievement;
- Incorporating the best technology into all aspects of the District's programs and operations;
- Providing optimal facilities and learning environments for all students; and
- Acquiring public and private funds for developing effective partnerships, including higher education, businesses, and the community.

Recommendations

Because the four-year NSF grant has been completed, there is no further funding from this particular grant. It is recommended that the Science Academy of Austin continue to seek grant funding for the continuing:

1. Training of teachers,

2. Uniting of elementary students with senior students for teaching and mentoring,

3. Development of innovative curricula, and

4. Development and/or maintenance of linkages with private business and public services for their assistance with Science Academy goals.

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SUMMARY

1994 Activities

The Science Academy of Austin met the objectives stated for the fourth year (beginning January 1994) of the National Science Foundation (NSF) grant. Overall, it appears that funds were used effectively to complete the development of an innovative environmental curriculum for high school students, train teachers, unite elementary students with high school students for teaching and mentoring, and development and/or maintain linkages with private business and public services.

During the fourth year of the grant, development of the high school curriculum *Watershed Studies* was completed. The curriculum is based on the grant's goal of developing integrative science courses that increase student learning and performance using holistic, interdisciplinary approaches with opportunities to apply concepts in real-world settings. *Watershed Studies* is currently ready for piloting in local high schools.

As dictated by the grant, staff development focused on giving teachers innovative means to help students become technologically, scientifically, and environmentally literate, as well as to train elementary and secondary teachers in the use of available technology. The intent this year was to synthesize technology training and curriculum development. This objective was accomplished by having teachers attend District, or outside District, technology training followed by the teachers developing curriculum plans that would incorporate the technology training they had received.

Science Academy and other LBJ High School students participated in elementary outreach activities that provided elementary students with hands-on science experience. Nearly all high school students indicated that they believed their participation was important to the elementary students. Additionally, high school students were able to experience working with children in a leadership and teaching role.

To meet the grant's goals of improving teacher skills and developing interdisciplinary curricula that contain real-world applications, the Science Academy of Austin sought to develop and/or enhance linkages among elementary and secondary teachers, students, and university science faculty, as well as to develop and/or enhance linkages with public and private sector leaders in science and technology. Developing new, and maintaining established, academic linkages provided an opportunity for elementary students to interact with and learn from secondary students. Linkages with public and private sectors enabled the Science Academy to acquire equipment, grants, training, technical advice, and assistance. In the 1994 school year, a total of $175,961 in cash was donated to the Science Academy from businesses and individuals. Additionally, the Science Academy also received donations in the form of equipment/supplies.

Four-year Grant Implementation

The National Science Foundation's four-year grant to the Science Academy has provided funds for computer technology training for teachers, student outreach activities, and curriculum development. The area of curriculum development has had the greatest impact, to the greatest number of students.

All curriculum development projects were coordinated and produced by teachers and participants from public organizations and private companies as stipulated by the original grant. Furthermore, all curriculum development projects that the Science Academy directed using NSF funds have been in line with the grant's goal of developing integrative science courses using holistic, interdisciplinary approaches with opportunities to apply concepts in real-world settings. In addition, student interviews suggested that the NSF-funded course, *Planet Earth*, had an impact on them that corresponded with stated course goals.

EVALUATION OVERVIEW

Data for the 1994 evaluation of the National Science Foundation's grant to the Science Academy of Austin were obtained from the following sources.

- The NSF grant application provided information on goals, objectives, and time line for project implementation.
- The summary edition of *Project 2061: Science for All Americans* provided information on the recommendations of the American Association for the Advancement of Science (AAAS) for science curriculum development.
- Science Academy course information provided detailed descriptions of *Planet Earth* and *Science and Technology* course outlines and objectives.
- Interviews with the grant's project director, project facilitator, and project secretary provided detailed information on the implementation of and participants in curriculum development activities, staff development activities, student involvement activities, and private sector linkages.
- Questionnaires provided student perceptions of their involvement in elementary outreach activities.
- Interviews with three *Planet Earth* students provided information on students' perceptions of the content, importance, and uniqueness of the course curriculum from the students' perspective.

INTRODUCTION

The Science Academy of Austin was given a four-year National Science Foundation (NSF) grant beginning in 1990-91. This evaluation report, covering the fourth (and last) year of project activities, summarizes the major accomplishments, both in the fourth year and over the four-year life of the grant, that grant funding has afforded.

For the past four years, the NSF grant to the Science Academy of Austin has provided a vehicle for linking the public and private sectors in Austin with the school system, providing in-depth partnerships for the creation of a curriculum that incorporates "constructivist learning" (Office of Educational Research and Improvement, 1990). Constructivism postulates that learning is far more than an accumulation of facts. From the constructivist viewpoint, learning occurs as an active process that integrates new information with prior conceptions. This process is greatly facilitated when learners engage in active participation within the context that the information is used and needed. Tangible experiences such as those acquired in contextual hands-on activities provide the base from which students discover the relevance of the information they are learning, as well as deeper learning of the concepts. Public and private businesses and institutions have assisted in contributing knowledge and equipment to provide students with real-word contexts for constructivist learning.

Throughout the four-year funding, two goals have guided the use of NSF funds for the transformation of existing educational practices:

1. To imrove teaching skills (grades K-12) with technology tools that are available but under-utilized, and

2. To increase student learning and performance in science using holistic, interdisciplinary approaches with opportunities to apply concepts in real-world settings.

To address these goals, the NSF grant activities are divided into four components: *curriculum development, staff development, student participation, and private sector involvement.* Throughout the four-year funding, NSF funds have provided:

- Staff development in technology and environmental issues,
- Student involvement in outreach activities to elementary schools,
- Development of curricula that incorporate interdisciplinary studies and/or authentic activities,
- Development of new private and public sector partnerships, as well as the expansion and/or maintenance of existing private and public sector linkages,
- Follow-up on previously funded activities,
- One half-time secretary,
- One half-time project facilitator, and
- Program evaluation.

1994 ACTIVITIES

CURRICULUM DEVELOPMENT

Watershed Studies, the final NSF grant-funded curriculum, began development during the summer of 1993. Its main focus is on the impact humans have on water quality. For information concerning the initial development and the content of *Watershed Studies*, see Constructing Tomorrow's Science Classrooms Today (ORE Publication No. 92.29). In June 1994, 10 teachers convened to write the lesson plans for the curriculum which were then submitted to the NSF grant project facilitator. The *Watershed Studies* curriculum is now available for pilot testing. A grant proposal has been submitted to the Environmental Protection Agency (EPA) to supply the funds necessary for pilot testing and distribution of the curriculum.

STAFF DEVELOPMENT

For 1994 technology training activities, the Science Academy director chose to take a different approach to the traditional summer technology staff development (previously called "The Technology Institute"). (For descriptions of previous Technology Institutes, see ORE Publication No. 90.37 and ORE Publication No. 92.29.) The intent this year was to synthesize technology training and curriculum development. This objective was met by having teachers attend District, or outside District, technology training that met their individual needs followed by their developing curriculum plans that would incorporate their technology training into their courses.

Teachers who were interested in participating in this experimental program were invited to submit applications indicating:

- The technology training they wanted to attend,
- How they would incorporate their training into student course work, and
- How the training and curriculum development related to science, mathematics, and/or technology.

A total of 13 teachers participated in the technology training/curriculum development program. NSF grant money paid for teacher training, as well as stipends for curriculum development. A stipend was not paid until the teacher submitted a curriculum development proposal to the program director.

Teacher curriculum development projects included:

- An Internet training manual for teaching water quality monitors and environmental enthusiasts how to link up to the Texas Environmental Library and Resource Center;
- Five laboratory activities and experiments which were incorporated into the Biology II curriculum and implemented during the 1994-95 school year;
- Nine laboratory activities and experiments which were incorporated into the Physics I curriculum with activities that require students to use computer spreadsheet programs and graphing techniques to analyze and interpret data.

- A four-week elementary school science unit that guides students in exploring the world of animals through the use of computer CD-ROMs and videodiscs, and in using a computer word processing program to write about their discoveries;

- An elective Science Academy mathematics course in which the student studies various subjects in discrete mathematics using functions, matrices, and graphs to model real-world and scientific phenomena.

STUDENT OUTREACH

To assist in linking elementary with secondary learners, Science Academy and other LBJ High School students who were enrolled in the Environmental Science class participated in elementary outreach activities. The participating high school students provided elementary students from Becker, Brooke, Campbell, and Winn Elementary Schools with instruction, tutoring, and field-trip experiences. Elementary outreach students worked in a team consisting of three or four students. The team was responsible for the organization and implementation of all aspects of the outreach activity. Outreach activities for the fourth year of the NSF grant included:

- Tours of Pioneer Farms and the ACCO water treatment plant,

- In-class instruction, and

- Student tutoring.

Outreach activities are intended to have a positive effect on the elementary children by using high school students as mentors and role models and to expose elementary students to environmental science concepts. After the completion of the activity, elementary students often sent the high school students thank-you letters and pictures expressing how much they learned from the activity and their appreciation for the experience.

In addition to the intended effect on elementary school students, the outreach activities also aimed to have an effect on high school students. The high school students were fully responsible for the organization and implementation of the outreach activity. Having full responsibility required them to create and meet task deadlines and to do so in collaboration with team members. Additionally, high school students were able to experience working with children in a leadership and teaching role. At the end of the fall 1993 and spring 1994 semesters, participating high school students were asked to respond to a survey that contained six open-ended questions. The questions focused on the students' perception of their experiences and the effects of their participation.

Responding to the question, "What did you find most rewarding about participating in the Outreach Program?" students offered the following comments:

- The kids, because I got to see their interest in the environment and learning something new;

- Being a positive influence on the kids;

- Helping the kids with their studies, and feeling good because I could give back what I received at that age; and

- Telling the kids about things they can do to help the environment and how important it is.

In addition to comments about teaching the elementary students specific science concepts, students responding to the question, "How do you think you affected the students you worked with at the elementary school?" also offered:

- I think I left them a sense of knowledge and something to remember forever;
- I think we made the kids feel their importance in saving the environment;
- [We affected the students by] motivating them to work hard [and] by showing them they could do it; and
- [We gave them] an enjoyable learning experience.

Student responses to a question about challenges reflect a full range of student experiences. Their responses to "What did you find most challenging about participating in the Outreach Program?" included:

- My patience with kids; but as I got used to them, they also grew attached to me and knew when to be serious;
- Getting started and being organized;
- Getting the kids to be as interested in the environment and recycling as we are;
- Answering some of the questions the students had;
- The work preparing to do each session; and
- Getting my other group members to be willing to put as much effort into the project as I was.

LINKAGES

To meet the grant goals of focusing on issues of technology and curriculum by improving teacher technology skills and of developing interdisciplinary curricula that contain real-world applications, the Science Academy of Austin has sought to develop and/or enhance linkages among:

- Elementary and secondary teachers and students,
- Science Academy faculty and university science and mathematics faculty, and
- Science Academy faculty and public and private sector leaders in science, mathematics, and technology.

By forming public and private sector linkages, the Science Academy has been able to acquire equipment, grants, training, technical advice, and assistance. Participants from public organizations and private companies are extensively involved in all aspects of NSF grant implementation. For the history of Science Academy linkages, as well as linkages formed thereafter, see ORE Publication No. 91.11 and ORE Publication No. 92.29.

The Science Academy Advisory Board

The Science Academy Advisory Board is comprised of representatives from local corporations, higher education institutions, and AISD. The Board provides assistance and consultation in program and staff development and facilitates donations. The 1994 Science Academy Advisory Board was composed of the members listed in Figure 1.

FIGURE 1
1994 SCIENCE ACADEMY ADVISORY BOARD

Vaughn Aldridge **AT&T Long Distance Company**	Exalton Delco, Ph.D. (Retired) **Austin Community College**	Russell Painton **Tracor**
Ruth Bain **Texas Medical Association**	Lester Formby **Motorola Corporation**	Pete Palazzari **IBM Corporation**
H. David Balfour, Ph.D. **Radian Corporation**	Rudy Garza **S. A. Garza, Engineers**	Syed Rizvi **Sematech Corporation**
Ruben Betancourt **Abbott Laboratories**	William Kennedy **Texaco Chemical Company**	Shirley Sandoz **Lockheed Corporation**
Terry Bishop, Ph.D. **Austin Independent School District**	J. J. Lagowski, Ph.D. **The University of Texas**	Ron Shelly **Texas Instruments**
Mel Bland **Applied Materials**	Milton Lee **City of Austin**	Sue Sinkin-Morris (Retired) **Science Academy of Austin**
W. H. Brader, Ph.D. (Retired) **Texaco Chemical Company**	Paul Leeke **3M Corporation**	Keith Thomas **Texas Instruments**
Gerald Briney (Retired) **IBM Corporation**	Judith Livingston **Texas Medical Association**	Toni Turk, Ph.D. **Austin Independent School District**
John Burns **Mesa Systems**	Mary Long **Science Academy of Austin**	Charles Warlick, Ph.D. **University of Texas, Computer Center**
John Clemmons **Southwestern Bell Telephone Company**	Jerry Mills **Texaco**	Sam Zigrossi **IBM Corporation**
	George More III **George More Investments**	

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Public and Private Sector Involvement

Yearly donations of equipment and/or cash are reported to AISD's Adopt-A-School office at the end of March for each school year. During 1994, a total of $85,589 was donated to the Science Academy from businesses and individuals in the form of grants and cash. In addition, the Science Academy received many equipment and supply donations. See Figures 2 and 3 for lists of donations.

FIGURE 2
DONATIONS OF CASH
TO THE SCIENCE ACADEMY, 1994

DONOR	PURPOSE	AMOUNT
Austin Independent School District Incentive Grant,1993-94	Supplied funds for a schoolwide science and mathematics symposium	$2,326
Austin Independent School District, 1994	To purchase a computer to work on the "Students Exploring Cyberspace" project	$3,000
Adopt-A-School, 1993-94	From AISD to pay for posters, booklets, supplies and travel money for speakers at a school wide/District wide science and mathematics symposium	$6,000
Austin Community Foundation, 1994	To purchase a video toaster for Science Academy teachers to produce instructional materials and for students in media production and other school-wide courses to produce videos and public service announcements.	$5,929
Classic Golf Association East Austin Youth Classic Grant, 1994	To network LBJ High School into a fiber optic and Internet network as the prototype school for this application of technology	$58,589
Quality Schools of Choice, 1994 (Awarded by Business Week and McGraw Hill)	To provide a partnership between AISD and the business community providing opportunities for students interested in science, technology, and mathematics through resources and internships	$2,250
Radian Corporation, 1994	To supply student research projects	$3,500
Texas Educational Association Innovative Grant, 1994	Given to two Science Academy biology teachers for innovative uses of technology in their classes	$4,000
TOTAL		$85,594

FIGURE 3
DONATIONS OF EQUIPMENT/SUPPLIES
TO THE SCIENCE ACADEMY, 1994

DONOR	DONATION
Individual Donor	200 feet of cabling, 12 BNC connectors
Individual Donor	Much time and manpower
Individual Donor	1 IBM 286 computer and printer
Individual Donor	Magazines: *American Scientist, Science, Science News*
Individual Donor	1 IBM 286 computer
Abbott	1 HP "D" size plotter
International Business Machine (IBM) Corporation	10 386 computers, 20 286 computers 30 token ring cards for micro channel machines 8 CPY units 65 Ethernet cards
Market Services	1 repeater box 1 MicroCom modem
Mesa Systems	2 token elite cards Much time and manpower
Motorola	1 monitor 11 rolling chairs 1 autoclave A group of office chairs
Sematech	150 copies of Word Perfect 8 LTE-286 Compaq laptops 30 PS2 Model 70 computers with VGA monitors & mice 2 laser printers, 1 high speed printer 5-6 printers of unknown condition
Southwestern Bell	Cost of connection line to maintain the Internet node at LBJ High School
Texas Instruments	6 LAN cards, 65 Ethernet cards 3 PS2 computer 1 manual for a laser printer donated by Sematech
University of Texas at Austin	A group of computers and equipment

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MAJOR PROGRAM ACCOMPLISHMENTS

CURRICULUM DEVELOPMENT OBJECTIVES

Throughout the past four years, the National Science Foundation's four-year grant to the Science Academy has provided funds for technology training for teachers, student outreach activities, and curriculum development. However, it is through curriculum development that the greatest impact, to the greatest number of students, has been accomplished. Furthermore, all curriculum development projects were coordinated and produced by teachers and participants from public organizations and private companies.

All curriculum development projects that the Science Academy directed using NSF funds have been in line with the grant's goal of developing integrative science courses that increase student learning and performance using holistic, interdisciplinary approaches with opportunities to apply concepts in real-world settings. Additionally, all NSF-funded curriculum development projects are in alignment with two major theories that are currently influencing science teaching reform. One theory with which NSF-funded curriculum development projects comply is that which is prescribed from a "constructivist" philosophy. A recent publication developed by The Studies of Education Reform, *Issues of Curriculum Reform in Science, Mathematics and Higher Order Thinking Across the Disciplines* (1994), contains information about implementing and sustaining successful innovations in education using constructivist principles. The Studies of Education Reform is a multidisciplinary effort supported by the U. S. Department of Education's Office of Educational Research and Improvement (OERI). Coming from a constructivist perspective, the report offers the following definitions of constructed learning which the authors believe should influence curriculum reform:

- The knower must construct his or her own meaning;
- The meaning that new knowledge has is contextually dependent;
- Learning is co-constructed;
- The teacher and student are equal partners in the learning process; and
- The accumulation of facts can no longer be the goal of education.

Another major influence in curriculum reform, Project 2061 (1990) contains science and environmental education reform recommendations that were developed by the American Association for the Advancement of Science (AAAS). All NSF-funded curriculum development projects have been designed to comply with Project 2061 recommendations that reforms in curricula should:

- Be thematic in their interdisciplinary approaches,
- Motivate students to think, solve problems, and make practical applications of scientific knowledge, and
- Present plans for actions which challenge students to change behavior(s).

CURRICULUM DEVELOPMENT PROJECTS

The following is summary information on the four curriculum development projects that were funded by the NSF grant.

Watershed Studies

The main focus of this curriculum is the impact humans have on water quality. Statewide water concerns are included to give Central Texas students a meaningful perspective on local and state water quality issues (e.g., subsidence due to groundwater pumping and salt water inflow from abandoned oil wells). Another aspect of the curriculum seeks to create an awareness of how personal actions can affect water quality. The curriculum is designed to present various ways for students to effect change. Another aspect of the curriculum focuses on career development and future water quality issues.

Curriculum writers were high school teachers, university professors, and professionals in fields concerned with issues of water quality and environmental protection. The completion of the *Watershed Studies* curriculum was accomplished in the final year of grant funding and is now available for pilot testing. (See ORE Publication No. 92.29 for information on *Watershed Studies* curriculum development.)

Get to the Point!

The *Get to the Point!* curriculum was developed in cooperation with the Lower Colorado River Authority (LCRA) for seventh- and eighth-grade students. It guides students through an exploration of water pollution which is not attributable to a specific source (e.g., a factory or land dump), called "nonpoint source pollution." Curriculum writers were teachers recruited from 10 lower Colorado River counties, selected because of their involvement in environmental education activities. The curriculum was originally piloted in 10 middle schools (four AISD middle schools, and six middle schools within lower Colorado River counties) during the 1991-92 school year. (See ORE Publication Nos. 90.37 and 91.25 for the history and initial implementation of this curriculum.) LCRA has been responsible for the distribution and training associated with the *Get to the Point!* curriculum. It reports that the *Get to the Point!* curriculum is currently being used in 63 schools within the 10 lower Colorado River counties.

Planet Earth

Planet Earth, a required tenth-grade Science Academy science course, integrates geology, physics, astronomy, chemistry, and biology. The curriculum was written by Science Academy science teachers with backgrounds in relevant areas. (See ORE Publication Nos. 90.37 and 91.25 for the history and initial implementation of this course and ORE Publication No. 92.29 for follow-up). The *Planet Earth* curriculum was first piloted in fall 1991 at the Science Academy. The *Planet Earth* curriculum has received the Texas Education Agency's approval for the course to be assigned "honors" credits.

Science and Technology

Science and Technology (originally named "Physics and Technology"), a required ninth-grade Science Academy science course, integrates physical science concepts, computers and computer applications, engineering design, and nuclear science using a "project-based" design. (See ORE Publication No. 92.29 for more information on *Science and Technology* curriculum development, implementation, and classroom observations.) The *Science and Technology* course was originally piloted during fall 1992 at the Science Academy. Since its inception, the *Science and Technology* curriculum has received theTexas Education Agency's approval for the course to be assigned "honors" credits.

The *Science and Technology* curriculum has received statewide and national attention. When the Conference for the Association of Science Teachers (CAST) held its annual meeting in Austin, 60 science teachers from around the state visited *Science and Technology* classes. *Science and Technology* teachers prepared a written course description, including a philosophical explanation of the course, for the CAST visitors, and held demonstrations of class activities with groups of students. In addition to the CAST visits, *Science and Technology* classes have received visiting educators from the Texas cities of Marble Falls, Conroe, College Station, and Bastrop who were interested in learning more about this innovative class.

The *Science and Technology* curriculum is recognized for its project-based approach, as well as its innovative ways to evaluate students within a curriculum that is not based on traditional lecture and paper-and-pencil-test strategies. Because the original curriculum was written for Science Academy two-hour time blocks, it was adjusted to meet the needs of high school science students, of all ability levels, within the time-frame of a typical classroom. During the 1994-95 school year, the curriculum was piloted in a non-Science Academy environment.

Writers are currently working with the Director of Science Education at the Texas Education Agency and the chairman of the Science Education from the University of Texas at Austin to format this innovative, project-based curriculum for outside-of-District dissemination.

ASSESSING CURRICULUM DEVELOPMENT GOALS

Motivation to Learn Using Authentic Problems

The NSF-funded curriculum *Science and Technology* was selected for observation, student interviews, and teacher interviews in the fall 1992 semester. The purpose was to determine if the students appeared to be motivated actively in the learning of physics. The *Science and Technology* course was chosen because it centers on "project-based" learning, a design that is purported to engage students in the investigation of authentic problems and to affect student motivation positively (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991). Classroom observations, student interviews, and teacher interviews suggested that the curriculum design promoted intrinsic motivation to learn. For a full description, see ORE Report No. 92.29.

Integration of Science Disciplines and Working on Real-World Problems

Interviews with students who have participated in another NSF-funded curriculum, *Planet Earth*, also suggest that science curriculum reform objectives were being met. As a follow-up to the previous evaluations which focused on student perceptions at the end of the semester (see ORE Publication No. 92.29), three 1994-95 senior Science Academy students were interviewed who had been students of the *Planet Earth* course in their junior year. The purpose of the interview was to gather students' retrospective opinion of the course and its importance to them. Students were asked to describe the course and what type of information they had learned, and what information, if any, they had learned that they felt was important.

The interviewed students described the course as being unique and important because the course:

- Had no textbook; course readings were obtained from current magazines, newspaper articles, and articles from the *Scientific American*;
- Topics were relevant to current civic and scientific issues;
- Topics focused on modern advances and current problems encountered in the scientific world, and discussions often focused on the "cutting edge" of scientific concerns;
- Integrated various scientific domains such as biology, chemistry, and geology with social domains such as religion and politics;
- Drew attention to the real-world application of science research; and
- Involved a semester-long project that was a hands-on science experience in the real world in which each student felt personal ownership and responsibility for his/her project, and
- Projects provided students with an opportunity to see how their research efforts had contributed to a larger civic research project.

Although it has been at least two years since the students were participants in the *Planet Earth* course, *their comments suggest that the course had an impact on them that corresponded with stated course goals. All of the interviewed students were preparing to attend colleges where they intended to pursue careers in physical or human sciences.*

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Publication Number 94.04
March 1996

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